

PATENT APPLICATION  
Application No. 10/621,710  
Paper Dated: March 4, 2005  
Attorney Docket No.: 128346.60401

### REMARKS

Applicants have reviewed the Office Action issued by the Examiner on December 14, 2004 and respectfully disagree that claims 1-15 of the present invention are not patentable over the cited art. For the reasons set forth below, Applicants believe that claims 1-15 are in condition for allowance.

Claims 1-15 have been rejected under 35 U.S.C. §103(a) for obviousness over U.S. Patent No. 5,468,268 to Tank et al. ("Tank"). Additionally, claims 1-15 stand rejected under 35 U.S.C. §103(a) for obviousness over U.S. Patent No. 6,132,675 to Corrigan et al. ("Corrigan"). Each of these rejections is respectfully traversed.

Independent claim 1 of the present invention is directed to a method for making a metal carbide supported polycrystalline diamond (PCD) compact having improved abrasion resistance properties. The cell assembly includes a body of diamond crystals and a support body adjacent the body of diamond crystals. The cell assembly is subjected to high pressure high temperature conditions for a sufficient amount of time and at a sufficiently high temperature to sinter the body of diamond crystals into a PCD layer and to bond the PCD layer to the carbide body. The body of diamond crystals includes a mixture of about 60-90 wt.% of a coarse fraction having an average particle size ranging from about 15-70 $\mu$ m and a fine fraction having an average particle size of less than about one half of the average particle size of the coarse fraction. The support body includes a mixture of a carbide of Group IVB, VB or VIB metal and at least a sintering binder-catalyst in an amount of about or less than 20 vol.% of the total weight of the support body.

Independent claim 8 of the present invention is directed to a sintered supported polycrystalline diamond (PCD) compact having abrasion resistance properties. The compact includes a body of diamond crystals and a support body in contact with the body of diamond crystals. The body of diamond crystals includes a mixture of about 60-90 wt.% of a coarse fraction having an average particle size ranging from about 15-70 $\mu$ m and a fine fraction having an average particle size of less than about one half of the average particle size of the coarse

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fraction. The support body includes a mixture of a carbide of Group IVB, VB or VIB metal and at least a sintering binder-catalyst in an amount of about or less than 20 vol.% of the total weight of the support body.

Tank is directed to a method of making an abrasive compact with ultra-hard abrasive particles using elevated temperature and pressure conditions. At least 25 mass % of the ultra-hard abrasive particles has at least three different average particle sizes with an average particle size range of 10-100 microns and at least 4 mass % of the ultra-hard abrasive particles have an average particle size of less than 10 microns.

Corrigan is directed to a high pressure high temperature method for making a metal carbide supported PCD compact. Corrigan discloses a mass of diamond particles having about 2-15 wt.% of submicron sized diamond particles having particle sizes ranging from about 0.01-1 micron and large sized diamond particles having particle sizes ranging from about 5-100 microns.

In the Office Action, the Examiner states that Tank and Corrigan disclose method steps to the claimed invention and teach the use of a mixture of coarse and fine diamonds, the amounts and size of the diamonds defined within the claimed range and therefore it would have been obvious to one having ordinary skill in the art at the time the invention was made to have selected the overlapping portion of the range disclosed by the references. Applicants respectfully disagree with the Examiner's statement.

Neither Tank nor Corrigan teach or suggest a sintered supported PCD compact or a method of making a metal carbide supported PCD as recited in independent claims 1 and 8 of the present invention. In particular, neither Tank nor Corrigan teach or suggest a cell assembly having a body of diamond crystals with a mixture of about 60-90 wt.% of a coarse fraction having an average particle size of 15-70 $\mu$ m and a fine fraction with an average particle size of less than about one half of the average particle size of the coarse fraction and a support body having a mixture of a carbide of Group IVB, VB, or VIB metal and at least a sintering binder-catalyst in an amount of about or less than 20 vol. % of the total weight of the support body.

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The present claimed invention is directed to increasing the abrasion resistance properties of a PCD compact by controlling the bimodal feed of diamond particles in the diamond body and the amount of binder/catalyst/sintering aid in the support body. As stated on page 5, lines 8-15 of the application, the greatest abrasion resistant is seen with a combination of lower binder/catalyst/sintering aid contents and the bimodal PCD mixtures. It was determined that the lower residual catalyst/sintering aid content in the carbide support layer in addition to the bimodal feed surprisingly produces a stiffer support that contributes beneficially to improve abrasion resistance of the sintered PCD compact product.

Clearly, neither Tank nor Corrigan teach or suggest a cell assembly having a diamond crystal body composition and a support body composition or a method thereof as recited in independent claims 1 and 8 of the present invention. Tank merely discloses an abrasive particle mixture with at least three types of abrasive particles differing from each other in their average particle size. However, while Tank may disclose overlapping ranges of amounts and particle sizes in the diamond body and a binder amount in the cemented carbide, Tank clearly does not teach or suggest the usage of all of the claimed features concurrently, for example, the claimed mixture of particles of the diamond crystal body and the support body having a sintering binder-catalyst in an amount of about or less than 20 vol.% of the total weight of the support body for improving abrasion resistance.

Additionally, Corrigan discloses 2-15 wt.% submicron sized diamond particles of 0.01-1 micron and 5-100 microns to achieve improved thermal stability, abrasion and wear resistance and impact resistance properties. Similarly, while Corrigan may disclose overlapping ranges of amounts and particle sizes in the diamond body and a binder amount in the cemented metal carbide support layer, Corrigan clearly does not teach or suggest the recited combination of particle size and amounts in the diamond body crystal and the support body having a sintering binder-catalyst in an amount of about or less than 20 vol.% of the total weight of the support body to improve abrasion resistance. Accordingly, neither Tank nor Corrigan teach or suggest a PCD compact or a method of making thereof having a cell assembly with a diamond crystal and support body composition as recited in independent claims 1 and 8.

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Moreover, the combination of amounts and particle sizes of the diamond body and the amount of sintering binder-catalyst in the support body of the claimed invention produces unexpected results over the ranges disclosed in Tank and Corrigan. Table 1 in the application illustrates abrasion wear test results (samples 1-6) using various diamond compositions and sintering binder-catalyst amounts in the support body. Specifically, samples 1 and 2 are characterized as the inventive samples with the remaining samples 3-6 being comparative samples. The inventive samples, 1 and 2, where both particle size distribution and sintering binder-catalyst amounts are controlled, clearly achieve a lower wear thereby demonstrating improved wear resistance in comparison to samples 3-6. In particular, sample 3 reflects controlling the sintering binder-catalyst amount without controlling the diamond composition. Sample 3 however does not achieve minimum wear resistance as achieved by the inventive samples. Samples 4 and 6 consequently reflect controlling the diamond composition without controlling the sintering binder-catalyst amount. Similar to sample 3, samples 4 and 6 failed to achieve low wear values, thereby resulting in excessive wear of the PCD. Therefore, as demonstrated by inventive samples 1 and 2, controlling the particle sizes/amounts of the diamond body and the amount of sintering binder-catalyst provides optimum wear resistance and clearly demonstrates unexpected results over the teachings of Tank and Corrigan.

Furthermore, Tank and Corrigan teach away from controlling amounts and particle sizes in a diamond body with an amount of a sintering binder/catalyst in a support body to achieve improved abrasion resistance. Tank discloses in col. 3, lines 13-14, that the method of the invention is characterized by the abrasive particle mixture which is used and therefore attributes wear resistance properties to only controlling particle size and amounts. Corrigan discloses in col. 4, lines 44-51, that the particle size differential solubility/dissolution rate effect results in the supported PCD compacts having physical properties improved over conventional supported PCD compacts wherein the large or fine sized diamond particles are used alone. Col. 4, lines 63-65 of Corrigan further states that the PCD compact of the invention is characterized as having a mixture of relatively large sized diamond particles and fine diamond particles. Corrigan is also focused on only using bimodal particle composition to achieve the desired properties. Accordingly as stated above, neither Tank nor Corrigan teach or suggest controlling

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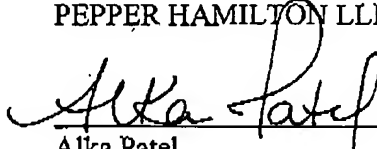
the combination of the bimodal feed and the sintering binder/catalyst in the support body as recited in independent claims 1 and 8 to achieve improved abrasion resistance. In view of the above comments, Applicants respectfully request reconsideration of the Examiner's rejections of independent claims 1 and 8.

Claims 2-7 depend directly or indirectly from and add further limitations to independent claim 1, and are deemed to patentable for the reasons discussed hereinabove in connection with independent claim 1. Claims 9-15 depend directly or indirectly and add further limitations to independent claim 8 and are deemed to be patentable for the reasons discussed hereinabove in connection with independent claim 8. Reconsideration of the rejections of the claims 2-7 and 9-15 is respectfully requested.

In view of the foregoing, reconsideration of the Examiner's rejections and allowance of claims 1-15 is respectfully requested. Should the Examiner have any questions regarding any of the foregoing, the Examiner is invited to contact Applicants' undersigned representative by telephone at (412) 454.5000.

Respectfully submitted,

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